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REMARKS

In this Amendment D, Applicants respond to the Office action of December 21, 2005 (with extension of time) in light of the further Office communication of March 22, 2006, following telephone
5 interview with Examiner Lee on March 21, 2006.

Status of Claims:

Claims 1-7, 12-15, 21 and 62 are pending in the application. Claims 1-4 and 12-15 stand allowed.
Claims 5-7, 21 and 62 were rejected. Claims 5, 6 and 7 are each further amended herewith, as according to
10 the proposal discussed during the interview.

Interview Summary

Examiner did not change from the view that claims 1-4 and 12-15 remain allowed. Even so, claims
5-7, 21 and 62 are rejected. In rejecting claims 5-7, 21 and 62, Examiner has continued to rely on
15 Alexander et al. US Pat. 4,198,646, and refers to Figure 2 of this '646 patent and the case decision *Ex parte*
Masham, 2 USPQ2d 1647 (Patent Office Board of Patent Appeals and Interferences, 1987), as to which the
examiner had said "it has been held that a recitation with respect to the manner in which a claimed apparatus
is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying
the claimed structural limitation."
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During the interview, the undersigned on behalf of Applicants adhered to the position that
Alexander fails to disclose the last or ultimate paragraph of each of claims 5, 6 and 7. Examiner, on the
other hand, continued to contend that Alexander in column 5, lines 56-63, disclosed the key feature, e.g.,
the "invalid charge discharging unit" of claim 5, and the "a dark current suppressing unit" of claim 5, and so
25 on as to claim 7 ("an excessive charge discharging unit").

As to claim 5, specifically, it was pointed out to Examiner that nothing in Alexander
disclosed the feature of Applicants' specification at p. 29, lines 26-30, which sets forth these
features in this way:
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When a charge accumulating time is extended in order to detect weak light, the dark current accumulated into the CCD diffusion layers 13 become not negligible. For this reason, the vertical transfer unit 16, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 to discharge invalid charges out of the CCD diffusion layers 13, so that the dark current are suppressed as much as possible.

The examiner then observed that if a limitation relating to these features were added to each of claims, then the examiner would consider them favorably.

The examiner has not yet reviewed these specific claims but was amenable to reconsidering based on amendment.

Applicants do therefore further amend claims 5, 6 and 7 by providing amendment consistent with the proposed amendment indicated above and requests that Examiner reconsider them favorably.

Nature of the Rejections Prior to This Response

For the convenience of Examiner and Applicants, it is helpful to review the prior action.

Response to Rejection under 35 U.S.C. 102(b):

Examiner had rejected claims 5-7, and 21 and 62 as being anticipated by Alexander et al., but Applicants have argued that the inventions disclosed in these claims are different from, and unobvious over, Alexander et al. in their configurations and functions, as more fully explained below. Applicants again assert that *Ex parte Masham*, 2 USPQ 2d 1647 (Patent Office Board of Appeals, 1987) is not applicable for reasons, among others, set forth below.

Applicants reaffirm and here incorporate by reference the arguments made in the Preliminary Amendment (Amendment C) accompanying the previously submitted Request for Continued Examination (RCE).

Regarding claim 5, Applicants have already noted that in referring to the limitation "invalid charge discharging unit" Examiner referred to only part of Applicants' claim 5, which includes the full limitation "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges." In doing so, Examiner referred to Alexander et al. at column 5, line 56-63 [actually that should for completeness of understanding be lines 52-63], which state:

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Bucket overload protection is assured by the creation of an overflow well 36 beneath the drain diffusion 22 of the detector 12 by the application of a positive (+30 volts) bias to the diffusion 22 and a lesser positive (+5 volts) bias to the bucket overload gate 28. As illustrated in FIG. 4a "excess" charge (the result of bloom at high illumination levels) adjacent the detector node 20 is dumped into the potential well 36 and removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown). The charge integration time of the detector 12 may be varied, if desired, and some signal charge dumped by clocking the bucket overload gates. *[Emphasis ours.]*

Examiner contended that the "invalid charge discharging unit" (as referred to by Examiner) in the present invention is disclosed in Alexander et al. but that simply is not true, because the configurations of the invalid charge discharging unit in the present invention and corresponding portions in Alexander et al. are different from each other.

Applicants have asked Examiner "where is the corresponding structural features in Alexander et al. that Examiner contends anticipate the apparatus set forth in claim 5?" Examiner has not so indicated, but Examiner referred to Alexander et al. at col. 2, lines 8-15, but that section of Alexander summarizes only the reading of the collected charge characters. The referenced patent Alexander et al. there only says "Charge advanced to the output diffusion results in a single output from one of a number of output amplifiers which are multiplexed onto a common bus. The outputs of a number of such buses present a number of lines of readout which may be arrayed to present the two-dimensional image of near-IR illumination detected by the imager." That disclosure by Alexander et al. has nothing to do with Applicants' claimed feature of "*an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges.*"

[Emphasis ours.] Examiner is asked to note carefully that the latter features relates to discharging of invalid charges while said charge accumulating units accumulate said signal charges. The invalid charge discharging unit sweeps invalid charges out of the charge transfer unit while the charge accumulating units accumulate signal charges. This eliminates a possibility of residence of dark current arising on the first-plane side of the charge transfer unit, so the image sensor has lessened occurrence of dark current, and this is further emphasized in the next page.

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Examiner also had referred to Alexander et al. at col. 5, lines 52-63, as disclosing removal of excess charges [i.e., from bloom at high illumination levels] but Examiner should more carefully note the description there in Alexander et al., which is:

5 Bucket overload protection is assured by the creation of an overflow well 36 beneath the drain diffusion 22 of the detector 12 by the application of a positive (+30 volts) bias to the diffusion 22 and a lesser positive (+5 volts) bias to the bucket overload gate 28. As illustrated in FIG. 4a "excess" charge (the result of bloom at high illumination levels) adjacent the detector node 20 is dumped into the potential well 36 and removed from the
10 drain diffusion 22 of the detector 12 by an overload bus (not shown). The charge integration time of the detector 12 may be varied, if desired, and some signal charge dumped by clocking the bucket overload gates. [Emphasis ours.]

What Examiner may have failed to notice is the statement (see above) by Alexander et al. of "... removed from the drain diffusion 22 of the detector 12 by an overload bus (not shown)."

15 In other words, there is *no disclosure* by Alexander et al. of anything corresponding to Applicants' claimed feature of "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges." At risk of repetition, there is not in Alexander et al. disclosure of a device or

20 circuit corresponding to what Applicants have set forth in claim 5. Applicants submit with respect that Examiner has attempted to equate "structures" as between Alexander et al. and Applicants' invention of claim 5, which the Examiner has not identified, and that Examiner has attempted to read into Alexander et al. structure that is not present, which Applicants contend is simply not permissible. The Alexander et al. patent discloses a "bucket overload gate 28."

25 Examiner should appreciate, however, that the Alexander et al. gate 28 is used to apply a bias voltage for spillover potential, so that substantially no charge carriers will be read out of said apparatus at said output diffusion until addressed by a transfer gate located in the readout layer.

Again Applicants assert that *Ex parte Masham* is not properly applicable to the present case because Applicants' claims recite different elements which are specified with different
30 features and for different purposes.

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The Present Amendments

In claim 5, which recited the feature of "an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges," there is now further required the limitation:

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said invalid charge discharging unit comprising a vertical transfer unit which, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes to discharge invalid charges out of the charge transfer unit.

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During the interview, the undersigned pointed out that the combination having the an invalid charge discharging unit which drives said charge transfer unit to discharge an invalid charge while said charge accumulating units accumulate said signal charges,

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said invalid charge discharging unit comprising a vertical transfer unit which, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes to discharge invalid charges out of the charge transfer unit. is not taught by the cited art, including Alexander, and should be patentable.

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Applicants wish to emphasize that there is no teaching or useful suggestion of disclosure in the references of the corresponding apparatus which, as described in the specification and Applicants' drawings, is a vertical transfer unit 16 (which is not part of the semiconductor structure per se, but is shown in Applicants' Figure 1; and Examiner must appreciate that there is no such corresponding structure shown in Alexander et al. but instead only the readout structure and circuitry of that patent's Figure 5); and it is such vertical transfer unit 16 that, during the charge accumulating period, successively applies a transfer voltage to the transfer electrodes 15 to discharge invalid charges out of the CCD diffusion layers 13. The Alexander et al. patent has a different structure (and different purpose for same). See, for example, the heavily doped p-layer slab 26, namely "The slab 26 is grounded and acts as a plane to shield the electric fields occasioned by the above-mentioned biases from the charge carriers (electrons in the illustrated embodiment) generated in the substrate 14." (Alexander et al.; col. 4, lines 46-50. [Emphasis added.]) It is believed accordingly that claim 5 is properly allowable in the application.

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Similarly, in claim 6, which recites the feature of "a dark current suppressing unit which approximates a potential of the first-plane side of said charge transfer unit to a substrate potential to suppress dark current flowing in from said first-plane side, at least during a predetermined period while said charge accumulating units accumulate said signal charges" there is now added the requirement of

5 said dark current suppressing unit comprising a vertical transfer unit which, during the charge accumulating period, successively applies a transfer voltage to transfer electrodes of the charge transfer unit by approximating the potential of the charge transfer unit to a substrate voltage, so that the dark current flowing into the charge transfer unit is suppressed as much as possible.

10 Again, for the reasons set forth above regarding claim 5, there is not in the cited art a disclosure this combination of claim 6 is not taught and is not suggested by the teachings of the cited references, being not at all disclosed therein. It is believed accordingly that claim 6 is properly patentable in the application and should be allowed..

15 Then also, in claim 7, which includes the recited feature of "an excessive charge discharging unit which overflows an excessive charge into said charge transfer unit in a vertical direction, from the charge accumulating units on the second-plane side to the charge transfer unit on the first-plane side and drives said charge transfer unit to discharge said excessive charge, said excessive charge occurring due to exceeding a saturation charge amount of said charge accumulating units," there has now additionally been recited the

20 following limitation to the combination claimed:

said excessive charge discharging unit comprising a vertical transfer unit which during the charge accumulating period, successively applies a transfer voltage to transfer electrodes of the charge transfer unit to discharge invalid excessive charges out of the charge accumulating units.

25 Again, there isn't in the cited art a disclosure this combination and is not fairly suggested by the teachings of the cited references, being not at all disclosed therein. It is believed accordingly that claim 7 is properly allowable in the application.

30 The foregoing amendments find support in the present specification and drawings and should accordingly not be considered new matter.

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Therefore, it is believed that claims 5, 6 and 7, as amended, are properly patentable in the application as setting forth highly advantageous sensors which are not taught or rendered obvious to the ordinarily skilled artisan by the prior art. Their allowance is requested
5 accordingly.

Regarding claim 21, it should be noted that claim 21 was previously amended so that it is dependent on claim 5. Therefore, because claim 5 is free of reasons to reject, claim 21 should also be. It is submitted to be allowable with claim 5.

Claim 62 is dependent also from claim 5. Therefore, because claim 5 is free of reasons to reject, claim 21 should also be. It is submitted to be allowable with claim 5. Again, for the reasons set forth above,

Summary

Accordingly, claims 1-7, 12-15, 21 and claim 62 are believed to be neither anticipated nor rendered obvious by the art of record.

The rejections based on Alexander et al. and *Ex parte Masham*, 2 USPQ 2d 1647 (Patent Office Board of Appeals, 1987) properly should be withdrawn.

It is believed that the foregoing resolves all remaining issues, and the application is in good order for allowance, and a Notice of Allowance is solicited. If Examiner believes there is any remaining issue, which could be readily resolved or other action could be taken to advance this application, such as Examiner's amendment or interview by telephone or in person, it is requested that Examiner please telephone the undersigned, who will cooperate to advance prosecution, and who will if necessary be prepared to interview
25 in the application.

A petition for extension is herewith submitted.

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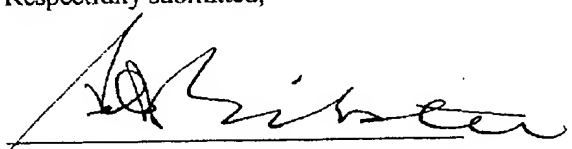
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If necessary to effect a timely response, this paper and accompanying documents should be considered as a petition for extension of time of length sufficient to be considered timely. Any fees required are authorized to be charged to Deposit Account No. 07-1985.

Respectfully submitted,

20 April 2006

Date


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Attachments: Transmittal with Certificate of Fax Transmission
Petition for Extension with Fee Authorization

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